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(54) **NON-AQUEOUS ELECTROLYTE CELL**

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a non-aqueous electrolyte cell that prevents expansion of laminated films even when gas is generated.

SOLUTION: The cells are contained within outer member consisting of laminated films and sealed by fuse-heating. A gas adsorbing substance is provided between outmost layer of the outer member and cells.

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CLAIMS

[Claim(s)]

[Claim 1] The nonaqueous electrolyte cell characterized by having the gas adsorption nature matter between the outermost layer of the above-mentioned sheathing material, and the above-mentioned cell component in the nonaqueous electrolyte cell which a cell component is held in the sheathing material which consists of a laminate film, and heat joining comes to enclose.

[Claim 2] The above-mentioned gas adsorption nature matter is a nonaqueous electrolyte cell according to claim 1 characterized by being the metallic oxide of porosity nature, or the carbon material of porosity nature.

[Claim 3] The metallic oxide of the above-mentioned porosity nature is a nonaqueous electrolyte cell according to claim 2 characterized by being a zeolite, an alumina, a molecular sieve, a titania, silica gel, or a zirconia.

[Claim 4] The carbon material of the above-mentioned porosity nature is a nonaqueous electrolyte cell according to claim 2 characterized by being activated carbon or a carbon molecular sieve.

[Claim 5] The nonaqueous electrolyte cell according to claim 1 characterized by inserting in the 1st [or more] page of the above-mentioned cell component the gas adsorption nature member by which it comes to fabricate the above-mentioned gas adsorption nature matter and a resin ingredient beforehand.

[Claim 6] The nonaqueous electrolyte cell according to claim 1 characterized by carrying out the endocyst of the above-mentioned gas adsorption nature matter into the above-mentioned laminate film.

[Claim 7] The nonaqueous electrolyte cell according to claim 1 characterized by the electrolyte which constitutes the above-mentioned cell component being the gel electrolyte or solid electrolyte containing a matrix giant molecule and lithium salt.

[Claim 8] The negative electrode which constitutes the above-mentioned cell component is a nonaqueous electrolyte cell according to claim 1 characterized by including a dope and the ingredient which can be dedoped for a lithium.

[Claim 9] The nonaqueous electrolyte cell according to claim 8 characterized by a dope and the ingredient which can be dedoped being carbon materials about the above-mentioned lithium.

[Claim 10] The positive electrode which constitutes the above-mentioned cell component is a nonaqueous electrolyte cell according to claim 1 characterized by including the multiple oxide of a lithium and transition metals.

[Claim 11] The nonaqueous electrolyte cell according to claim 1 characterized by being a rechargeable battery.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the nonaqueous electrolyte cell which comes to hold a cell component in the sheathing material which consists of a laminate film.

[0002]

[Description of the Prior Art] In recent years, portable electronic equipment, such as a camcorder/movie, a cellular phone, and a luggable computer, appears mostly, and the small lightweight-ization is attained. And as a portable power source of these electronic equipment, researches and developments of a cell especially a rechargeable battery, and the cell in which a thin shape and bending are possible about a nonaqueous electrolyte rechargeable battery (the so-called lithium ion battery) especially are furthered actively.

[0003] Research of the electrolytic solution solidified as an electrolyte of the cell in which such a configuration is free is prosperous, and the solid polymer electrolyte which melted lithium salt in the electrolyte and giant molecule of the gel which is a solid electrolyte containing especially a plasticizer is capturing the spotlight.

[0004] On the other hand, the cell of the type enclosed using the so-called laminate film which made plastic film, plastic film, and a metal rival is variously examined in order to employ a merit called the thin light weight of such a cell efficiently.

[0005]

[Problem(s) to be Solved by the Invention] However, in the so-called laminate film, the rigidity is weak to the rigidity of a container having been strong and a cell container having not deformed easily to the pressure buildup inside a cell by the cell using the conventional metal well-closed container.

[0006] Therefore, when charge and discharge [made / in according to breakage of a control circuit etc. / the mistake] were carried out, or when it was left down to abnormality hot environments, there should have been a problem of having possibility that will carry out an internal pressure rise by the gas constituents generated in the anomalous reaction in that case, and a laminate film will swell, for example.

[0007] This invention is proposed in view of the conventional actual condition which was mentioned above, and even if gas occurs, it aims at offering the nonaqueous electrolyte cell which prevented the swelling of the laminate film which is a sheathing material.

[0008]

[Means for Solving the Problem] The nonaqueous electrolyte cell of this invention is a nonaqueous electrolyte cell which a cell component is held in the sheathing material which consists of a laminate film, and heat joining comes to enclose, and is characterized by having the gas adsorption nature matter between the outermost layer of the above-mentioned sheathing material, and the above-mentioned cell component.

[0009] Since the above-mentioned gas adsorption nature matter adsorbs generating gas even if gas generates the nonaqueous electrolyte cell concerning this invention which was mentioned above when a cell is put on the bottom of an abnormality situation since it has the gas adsorption nature matter between the outermost layer of the above-mentioned sheathing material, and the above-mentioned cell component, the swelling of a sheathing

material is stopped.

[0010]

[Embodiment of the Invention] Hereafter, the configuration of the nonaqueous electrolyte cell which applied this invention is explained, referring to a drawing.

[0011] As it is a solid electrolyte cell or a gel electrolyte cell and is shown in drawing 1 and drawing 2, the nonaqueous electrolyte cell of this invention holds the cell component 1 which arranges a solid electrolyte or a gel electrolyte between a positive-active-material layer and a negative-electrode active material layer, and becomes in the sheathing material 2 which consists of a laminate film, and it comes to enclose it by carrying out heat welding of the perimeter.

[0012] The negative-electrode terminal lead 3 electrically connected with the negative electrode which constitutes the cell component 1, and the positive-electrode terminal lead 4 electrically connected with a positive electrode are formed in the above-mentioned cell component 1, and these negative-electrodes terminal lead 3 and the positive-electrode terminal lead 4 are pulled out outside the sheathing material 2 to the way.

[0013] And in the nonaqueous electrolyte cell concerning the gestalt of this operation, the gas adsorption nature members 5 and 6 are inserted in the winding end face of the cell component 1 the 1st [at least / or more] page of the fields which exist between the cell component 1 and the outermost layer of a laminate film (sheathing material 2), and here, respectively. Even if gas occurs inside the cell component 1 according to abnormality environments, such as an elevated temperature and overcharge, gas should adsorb according to a gas adsorption operation of the gas adsorption nature members 5 and 6, and deformation of the cell by the swelling of a sheathing material 2 should be prevented. These gas adsorption nature members 5 and 6 consist of gas adsorption nature matter and a resin ingredient.

[0014] As gas adsorption nature matter, the metallic compounds of porosity nature or the carbon material of porosity nature is used. A zeolite, an alumina, a molecular sieve, a titania, silica gel, a zirconia, etc. are specifically as metallic compounds of porosity nature mentioned. Moreover, specifically, activated carbon, a carbon molecular sieve, etc. are mentioned as a carbon material of porosity nature.

[0015] Moreover, magnesium sulfate, nickel, platinum, palladium, calcium, Sr, Ba, Ti, Zr, Hf, V, Nb, Ta, Cr, Mo, W and Fe, a calcium chloride, phosphorus pentoxide, etc. can be used as gas adsorption nature matter besides metallic compounds of porosity nature which were mentioned above, or the carbon material of porosity nature. One kind may be independently used for gas adsorption nature matter which was mentioned above, and two or more sorts may be mixed and used for it.

[0016] In order to be dependent on the electrolyte salt used for a gel electrolyte layer, and the class and amount of a solvent, the gas constituents which may be generated, and its amount constitute an electrolyte with what kind of ingredient, and depend also for the class and amount of the gas adsorption nature matter which should be thrown in on in what amount the constituted electrolyte is used greatly.

[0017] For example, the propylene carbonate which shows graphite and high reactivity first, using graphite as a negative-electrode active material, using LiCoO_2 as positive active material was used as the electrolyte solvent, and the cell of 500mh class was produced using 1.5g of electrolytic solutions which dissolved and prepared LiPF_6 by the concentration of 1.0 mol/kg as an electrolyte salt. The gas which left it for 100 hours and

occurred under 100 degrees C in the condition of having overcharged to 4.35v, about this cell was analyzed in GC-MS. Consequently, the propylene carbonate which reacted was about 10% of the injection whole quantity, and the principal components of generating gas were a carbon dioxide, a propane and a propylene, and evaporated unreacted propylene carbonate.

[0018] Moreover, even after cooling a cell to a room temperature, 10% the carbon dioxide for a little less than and propane which reacted among 1.5g of propylene carbonate electrolytic solutions, and the propylene existed as gas. And it was checked that 5A carbon molecular sieve with about 2/g 3000m adsorption surface area can stick to these gas nearly completely by 0.07g. Even if a propylene carbonate electrolytic solution will make decomposition 100% soon, it will turn out that what is necessary is just to supply the 0.7g of the above-mentioned 5A carbon molecular sieves.

[0019] Although it is thought that there may be few inputs of the gas adsorption nature matter since a cell is constituted actual more from a reactant combination of a low ingredient, although the case where a cell was constituted more from a reactant combination of a high ingredient was mentioned in the above-mentioned example, it depends for the optimal class of gas adsorption nature matter and selection of an amount on the combination of various cell components greatly. Therefore, as for the class and amount of the gas adsorption nature matter to be used, it is desirable to select suitably in an actual fuel cell subsystem.

[0020] moreover, as a resin ingredient which constitutes the gas adsorption nature members 5 and 6 For example, polyethylene, polypropylene, polyethylene terephthalate, Polyimide, polyamidoimide, a polyamide, polyphenylene sulfide, A tetrafluoroethylene-perfluoroalkyl vinyl ether copolymer, Polyvinylidene fluoride, polytetrafluoroethylene, a fluoride ethylene polypropylene copolymer, At least one or more kinds of things chosen from the Pori ethylene tetrafluoroethylene copolymer and vinyl fluoride, an epoxy resin, acrylic resin, methacrylic resin, and these mixed stock resin and bridge formation mold resin can be used.

[0021] If the resin of a bridge formation system is used, for example Moreover, 2-hydroxyethyl (meta) acrylate, 2-hydroxypropyl (meta) acrylate, glycerol (meta) acrylate, 2-acrylamido-2-methyl propane sulfonic acid, sulfonic-acid sodium ethyl (meta) acrylate, Acrylamide, N, and N-dimethylaminoethyl (meta) acrylate, (Meta) N and N-diethylaminoethyl (meta) acrylate, N-isopropyl acrylamide, N,N-dimethylaminopropyl acrylamide, an acrylic acid (meta), Acrylic-acid sodium, 2-(meta) acryloyloxyethyl succinic acid, (Meta) 2-(meta) acryloyloxyethyl phthalic acid, 2-(meta) acryloyloxyethylhexahydrophthalic acid, Omega-carboxy-polycaprolactone monoacrylate, EO denaturation phosphoric-acid (meta) acrylate, Polyethylene-glycol (meta) acrylate, acryloyl morpholine, p-styrene sulfonic acid, a vinyl sulfonic acid, an allyl compound sulfonic acid, an ethyl-acrylate (meta) sulfonic acid, (Pori) ethylene GURIKORUJI (meta) acrylate (; by the new Nakamura chemistry company -- trade name NK ester A-200, A-400, A-600, A-1000, and 4G --) 9G, 14G, 23G, and; [by the Kyoeisha chemistry company] light ester -- 9 EG 4 EG ethylene glycol (Pori) monochrome (meta) acrylate (; by the new Nakamura chemistry company -- NK ester AMP-10G --), such as 14EG(s), 9 EG-A, and 14 EG-A AMP-20G, AMP-60G, AMP-90G, the Kyoeisha chemistry company make; light ester MC, 130MA, 041 etc.MA (new Nakamura chemistry company make; trade name NK ester 1206PE) of ethoxylation polypropylene-glycol dimethacrylate etc.,

etc. can be mentioned. These may be used independently, or may mix and use plurality. As a hardening means, heat, ultraviolet rays, a visible ray, an electron ray, a radiation, etc. are mentioned.

[0022] If ultraviolet curing is used, as the initiator For example, the sodium methyl dithiocarbamate sulfide activated by ultraviolet rays, Tetramethylthiuram monosulfide, diphenyl monosulfide, Sulfide, such as dibenzo thiazoyl monosulfide and disulfide; A thioxan ton, An ethyl thioxan ton, 2-chloro thioxan ton, a diethyl thioxan ton, Thioxan ton derivatives, such as a diisopropyl thioxan ton; A hydrazone, Diazo compounds, such as azo-isobutyro-dinitrile and benzene diazonium; A benzoin, Benzoin methyl ether, benzoin ethyl ether, benzoin iso-propyl ether, A benzophenone, a dimethylamino benzophenone, a Michler's ketone, Benzyl anthraquinone, t-butyl anthraquinone, 2-methyl anthraquinone, 2-ethyl anthraquinone, 2-aminoanthraquinone, 2-chloro anthraquinone, Aromatic series carbonyl compound; 1-hydroxy cyclohexyl phenyl ketone, such as benzyl dimethyl ketal and methylphenylglyoxylate, 2-hydroxy - 2-methyl-1-phenyl propane-1-ON, 4-(2-hydroxy ethoxy) phenyl (2-hydroxy-2-propyl) ketone, Acetophenone derivative; 4-dimethylamino methyl benzoates, such as 2 and 2-diethoxy acetophenone, 2, and 2-dimethoxy acetophenone, 4-dimethylamino ethyl benzoate, 4-dimethylamino benzoic-acid butyl, Dialkylamino benzoates, such as 4-diethylamino benzoic-acid isopropyl; Benzoyl peroxide, Peroxide; 9-phenyl acridines, such as di-t-butyl peroxide, dicumyl peroxide, and cumene hydroperoxide, A 9-p-methoxyphenyl acridine, 9-acetyl amino acridine, Acridine derivatives, such as a bends acridine; 9, 10-dimethyl bends phenazine, 9-methyl bends phenazine, phenazine derivative [, such as 10-methoxy bends phenazine], ; -- 4, 4', and 4" -- quinoxaline derivative [, such as - trimethoxy-2 and 3-diphenyl quinoxaline] ; -- 2, 4, and 5-triphenyl imidazoyl dimer; halogenation ketone; acyl phosphine oxide -- Although acylation phosphorus compounds, such as reed RUHOSUFONA-TO, etc. are mentioned, it is not limited to this.

[0023] Moreover, a 2-nitro fluorene [which is activated by the visible-ray twist], 2 and 4, 6-tris (TORIKURORO methyl)-1,3,5-triazine, 3, and 3'-carbonyl bisque marine ** thio Michler's ketone etc. can also be used.

[0024] These may be used independently, and two or more kinds may be mixed and used for them.

[0025] if it increases, since sufficient reactivity will not be acquired if it decreases, but the point constructing a bridge decreases, and loadings tend to become soft, and it will become weak or will be easy to discolor -- desirable -- 0.01 - 20 weight section -- it is 0.1 - 5 weight section more preferably.

[0026] As a source of an exposure of an activity beam of light, when irradiating ultraviolet rays, an ultrahigh pressure mercury lamp, a high pressure mercury vapor lamp, a metal halide lamp, a xenon lamp, a low voltage germicidal lamp, etc. are used as the light source. Although the exposure of ultraviolet rays changes also with the class of monomer, and abundance of a photopolymerization initiator, 10 mJ/cm² - 10 J/cm² are suitable for it. Under the present circumstances, in order to prevent oxygen inhibition, UV irradiation may be performed where atmospheric air is intercepted with the bottom of an inert gas ambient atmosphere or glass, transperance plastic film, etc.

[0027] The gas adsorption nature members 5 and 6 mix gas adsorption nature matter powder and a resin ingredient which were mentioned above, and are formed in tabular by making it harden. What is necessary is to extrude or just to consider as a desired gestalt

with injection molding etc. after kneading, if thermoplastic resin is selected as a resin ingredient.

[0028] As for the amount of the gas adsorption nature matter, it is desirable to **** to extent to a resin ingredient 0.1 % of the weight or more and 95 % or less of the weight. If there are few amounts of the gas adsorption nature matter to a resin ingredient than 0.1 % of the weight, a gas adsorption operation will not fully be acquired. Moreover, if there are too more amounts of the gas adsorption nature matter to a resin ingredient than 95 % of the weight, a resin ingredient will decrease and shaping of a gas adsorption nature member will become difficult.

[0029] In fact, as mentioned above, it depends on the combination of various cell components for the class and amount of the occurring gas greatly. Therefore, as for the amount of the gas adsorption nature matter, it is desirable to select suitably in an actual fuel cell subsystem.

[0030] Moreover, that it will become [in / it is important, for example, / a cell with a thickness of 3mm / 100-micrometer] thick how this thickness is finished thinly if it is the cell of the same capacity when the shortest length of a cell dimension is defined as the thickness of a cell means that volumetric efficiency worsens in 3%. Moreover, that 100 micrometers becomes thick by the cell with a thickness of 0.5mm means that volumetric efficiency worsens in 20%. Although it is greatly dependent on the configuration of a cell, the gas adsorption nature matter of sufficient amount for gas adsorption can be thrown in suppressing reduction of volume energy efficiency as much as possible, if the tabular gas adsorption nature members 5 and 6 are allotted between the laminate films which are the cell component 1 and a sheathing material 2 like drawing 1 if it is the cell of card size, for example and is 3mm or more in thickness.

[0031] In the case of a tabular gas adsorption nature member, the thickness has 50 micrometers or more and 1.0 desirablemm or less. If the thickness of a gas adsorption nature member is thicker than 1.0mm, the loss of volume energy density will become large. Moreover, if the thickness of a gas adsorption nature member is thinner than 50 micrometers, though amount content is carried out, sufficient fabricating to tabular will become difficult about the gas adsorption nature matter. More desirable thickness is 100 micrometers or more and 500 micrometers or less.

[0032] Thus, in the nonaqueous electrolyte cell which has the sheathing material which consists of a laminate film, it has the cell component which consists of a positive electrode and a negative electrode inside, and the gas adsorption nature matter should just be inserted in one between the cell component and outermost layer of a laminate film of parts.

[0033] For example, if the whole surface of the cell component 1 is covered by such gas adsorption nature member 8 as shown in drawing 3 , the purpose can be attained easily. However, if the whole surface of the cell component 1 is covered, since the rate of things other than cell component 1 which the slash field shown in drawing 4 serves as a volume loss, and is occupied in the cell case of the limited volume will become high and the volume energy efficiency of a cell will fall as a result, it is not necessarily a best policy.

[0034] Therefore, what is necessary is just to arrange the gas adsorption nature member of the gas adsorption nature matter endocyst of this invention in a certain limited location.

[0035] In arranging the above-mentioned gas adsorption nature member, the cell component 1 may be enclosed in a laminate film, inserting the gas adsorption nature

members 5 and 6 of the shape of sheet metal fabricated beforehand, as shown in drawing 5 , and spreading posture of the resin of hardenability may be carried out to a cell component, and you may enclose in a laminate film.

[0036] Moreover, when using the laminate film with which the space which holds a cell in the 1st page with a laminate film was formed, the approach of holding a cell component in the space, making fill up with and harden the gas adsorption nature matter and the resin of hardenability after that, and closing a laminate film after that may be used. In this case, as shown in drawing 6 , the gas adsorption nature member 7 will be formed in the perimeter of the cell component 1.

[0037] Or the endocyst of the gas adsorption nature matter may be carried out to one of the film layers by the side of the cell contiguity which constitutes a laminate film.

[0038] As shown in drawing 7 in this case, the laminating of the resin layer 11 with a thickness of about 10 micrometers it is thin in order from nylon or polyethylene terephthalate, the aluminum layer 12 with a thickness of 20 micrometers - 40 micrometers it is thin from aluminum, and the gas adsorbent layer 13 with a thickness of 30 micrometers - 50 micrometers by which resin, such as denaturation cast polypropylene (CPP), comes to distribute the gas adsorption nature matter will be carried out from an outside, and a laminate film 10 will be constituted. Moreover, as the gas adsorption nature matter is shown in drawing 8 , without making it distribute in resin, it is good also as a configuration which put gas adsorption nature matter 13b by resin layer 13a of the pair which consists the gas adsorbent layer 13 of resin, such as denaturation cast polypropylene.

[0039] When preparing a gas adsorbent layer as one of the configuration layers of a laminate film, the thickness has 1 micrometers or more and desirable 500 micrometers or less. If the thickness of a gas adsorbent layer is thicker than 500 micrometers, the loss of volume energy density will become large. Moreover, if the thickness of a gas adsorption nature member is thinner than 1 micrometer, it will become difficult about the gas adsorption nature matter sufficient to carry out amount content. More desirable thickness is 5 micrometers or more and 100 micrometers or less.

[0040] On the other hand, although it is the above-mentioned cell component 1 for example, when a solid electrolyte cell or a gel electrolyte cell is considered, as polymeric materials used for a solid polymer electrolyte Silicon gel, acrylic gel, acrylonitrile gel, the poly FOSUFAZEN conversion polymer, As fluorine system polymers, such as polyethylene oxide, polypropylene oxide and these compound polymers, and crosslinked polymer, a conversion polymer For example, Pori (vinylidene fluoro RAIDO) and Pori (vinylidene fluoro RAIDO-co-hexafluoropropylene), Although the various use of such mixture, such as Pori (vinylidene fluoro RAIDO-co-tetrafluoroethylene) and Pori (vinylidene fluoro RAIDO-co-trifluoro ethylene), can be carried out, of course, it is not limited to these.

[0041] The solid electrolyte by which the laminating is carried out to the positive-active-material layer or the negative-electrode active material layer, or a gel electrolyte infiltrates into a positive-active-material layer or a negative-electrode active material layer the solution which consists of plasticizer) further, and in the case of a high molecular compound, an electrolyte salt, a solvent, and (gel electrolyte, a solvent is removed, and it solidifies it. The part sinks into a positive-active-material layer or a negative-electrode active material layer, and the solid electrolyte by which the laminating

was carried out to the positive-active-material layer or the negative-electrode active material layer, or the gel electrolyte is solidified. After that, with light or heat, in the case of a bridge formation system, a bridge is constructed, and it is solidified.

[0042] A gel electrolyte consists of the plasticizer and - 2 % of the weight or more 30 or less % of the weight of the matrix macromolecule containing lithium salt. At this time, ester, ether, and carbonates can be used as independent or one component of a plasticizer.

[0043] In adjusting a gel electrolyte, the various macromolecules currently used for constituting a gel electrolyte as a matrix macromolecule which gels such carbonates can be used, but it is desirable to use fluorine system macromolecules, such as Pori (vinylidene fluoro RAIDO) and Pori (vinylidene fluoro RAIDO-co-hexafluoropropylene), from oxidation reduction stability, for example.

[0044] A giant-molecule solid electrolyte consists of lithium salt and a high molecular compound which dissolves it. As a high molecular compound Ether system macromolecules, such as Pori (ethyleneoxide) and this bridge formation object, a Pori (methacrylate) ester system, fluorine system macromolecules, such as an acrylate system, Pori (vinylidene fluoro RAIDO), and Pori (vinylidene fluoro RAIDO-co-hexafluoropropylene), etc. -- independence -- or, although it can mix and use It is desirable to use fluorine system macromolecules, such as Pori (vinylidene fluoro RAIDO) and Pori (vinylidene fluoro RAIDO-co-hexafluoropropylene), from oxidation reduction stability, for example.

[0045] Although the lithium salt used for the usual cell electrolytic solution as lithium salt which such a gel electrolyte or a giant-molecule solid electrolyte is made to contain can be used and the following are mentioned as a lithium compound (salt), for example, it is not limited to these.

[0046] For example, a lithium chloride, a lithium bromide, a lithium iodide, a chloric-acid lithium, lithium perchlorate, a bromic-acid lithium, an iodic-acid lithium, a lithium nitrate, a tetrafluoro way acid lithium, a hexa fluorophosphoric acid lithium, an acetic-acid lithium, a bis(trifluoromethane sulfonyl) imide lithium, LiAsF₆, LiCF₃SO₃, LiC(SO₂CF₃)₃ and LiAlCl₄, and LiSiF₆ grade can be mentioned.

[0047] Although these lithium compounds may be used independently or plurality may be mixed and used, LiPF₆ and LiBF₄ are desirable from the point of oxidation stability in these.

[0048] Although it can carry out by 0.1-3.0 mols in a plasticizer as concentration which dissolves lithium salt if it is a gel electrolyte, it can use by 1. in 2.0 mols /from 0.5 preferably.

[0049] The cell of this invention can be constituted like the conventional lithium ion battery except using the gel electrolyte or solid electrolyte containing the above carbonates.

[0050] That is, as a negative-electrode ingredient in the case of constituting a lithium ion battery, a dope and the ingredient which can be dedoped can be used for a lithium. The carbon material of the component of such a negative electrode, for example, a difficulty graphitized-carbon system ingredient, and a graphite system ingredient can be used. More specifically, carbon materials, such as pyrolytic carbon, corks (pitch coke, needle coke, petroleum coke), graphites, glassy carbon, an organic high-molecular-compound baking object (what calcinated and carbonized phenol resin, furan resin, etc. at suitable temperature), a carbon fiber, and activated carbon, can be used. In addition, as a dope and

an ingredient which can be dedoped, macromolecules, such as polyacetylene and polypyrrole, and the oxide of SnO_2 grade can also be used for a lithium. It faces forming a negative electrode from such an ingredient, and a well-known binder etc. can be added.

[0051] A positive electrode can be constituted according to the class of cell made into the purpose, using a metallic oxide, metallic sulfide, or a specific macromolecule as positive active material. For example, when it constitutes a lithium ion battery, as positive active material, the metallic sulfide or the oxide which does not contain the lithium of TiS_2 , MoS_2 , NbSe_2 , and V_2O_5 grade, the lithium multiple oxide which makes a subject LiMO_2 (the inside M of a formula expresses the transition metals more than a kind, and x changes with charge-and-discharge conditions of a cell, and it is usually 1.10 or less [0.05 or more].) can be used. As transition metals M which constitute this lithium multiple oxide, Co, nickel, Mn, etc. are desirable. As an example of such a lithium multiple oxide, LiCoO_2 , LiNiO_2 , $\text{LiNi}_{1-y}\text{Co}_y\text{O}_2$ (it is $0 < y < 1$ among a formula.), and LiMn_2O_4 grade can be mentioned. These lithiums multiple oxide can generate the high voltage, and serves as positive active material which was excellent in energy density. In accordance with two or more sorts of such positive active material, you may use it for a positive electrode. Moreover, it faces forming a positive electrode using the above positive active material, and a well-known electric conduction agent, a well-known binder, etc. can be added.

[0052] The electrode terminal (the negative-electrode terminal lead 3 and positive-electrode terminal lead 4) is joined to the charge collector of each forward negative electrode, and aluminum, titanium, or these alloys of a positive electrode are desirable as the quality of the material as what is not dissolved with high potential. A negative electrode can use copper, nickel, or these alloys.

[0053] Although these electrode terminals are bent so that it may become flat-tapped with one principal plane of the cell component 1 in the winding end face of the cell component 1 in consideration of volumetric efficiency, a drawer easy, etc., the above-mentioned gas adsorption nature members 5 and 6 and the gas adsorption nature member 7 function effectively also from a viewpoint of short circuit prevention, and function also as a shock absorber.

[0054] Although the nonaqueous electrolyte cell by which this invention is applied may be a primary cell and may be a rechargeable battery, it is a rechargeable lithium-ion battery using a solid electrolyte or a gel electrolyte most preferably.

[0055]

[Example] The cell as shown below was created that the effectiveness of this invention should be checked, and the property was evaluated.

[0056] <Example 1> Production place ** of a sample cell and a negative electrode were produced as follows.

[0057] as the ground graphite powder 90 weight section and a binder -- the Pori (vinylidene fluoro RAIDO-co-hexafluoropropylene) 10 weight section -- mixing -- a negative electrode -- prepared the mixture, the N-methyl-2-pyrrolidone was made to distribute this further, and it considered as the shape of a slurry. And this slurry was applied to homogeneity at one side of band-like copper foil with a thickness of 10 micrometers which is a negative-electrode charge collector, it pressed with the roll press machine after desiccation, and the negative electrode was produced.

[0058] On the other hand, the positive electrode was produced as follows.

[0059] In order to obtain positive active material (LiCoO₂), cobalt carbonate was mixed with the lithium carbonate by the ratio of one mol of 0.5-mol pairs, and it calcinated at 900 degrees C among air for 5 hours. next -- as the obtained LiCoO₂ 91 weight section and an electric conduction agent -- as the graphite 6 weight section and a binder -- the Pori (vinylidene fluoro RAIDO-co-hexafluoropropylene) 10 weight section -- mixing -- a positive electrode -- prepared the mixture, the N-methyl-2-pyrrolidone was made to distribute this further, and it considered as the shape of a slurry. And this slurry was applied to one side of band-like aluminium foil with a thickness of 20 micrometers which is a positive-electrode charge collector at homogeneity, after drying, it pressed with the roll press machine and the positive electrode was produced.

[0060] On the part (a positive electrode is aluminum foil and a negative electrode is copper foil) in which the active material layer of a positive electrode and a negative electrode is not formed, the negative-electrode terminal lead which consists of the positive-electrode terminal lead and nickel which consist of aluminum was welded.

[0061] Furthermore, the gel electrolyte was obtained as follows.

[0062] On the negative electrode and the positive electrode, weight average molecular weight Mw applies to homogeneity the solution which carried out the mixed dissolution of the Pori (vinylidene fluoro RAIDO-co-hexafluoropropylene) 10 weight section of 600,000, and the diethyl carbonate 60 weight section, and infiltrated the plasticizer 30 weight section which consists of the (ethylene carbonate EC) 42.5 weight section, the (propylene carbonate PC) 42.5 weight section, and the LiPF₆ 15 weight section, it was left in ordinary temperature for 8 hours, dimethyl carbonate was evaporated and removed, and the gel electrolyte was obtained.

[0063] The 3.3cmx5.2cmx3.3mm winding mold gel electrolyte cell component (capacity 550mAh) as shows the negative electrode which applied the gel electrolyte, and a positive electrode to drawing 9 by uniting and winding [stick by pressure and] a gel electrolyte side was produced.

[0064] What carried out 0.5 weight section mixing of the Ciba-Geigy make and the trade name 1173, and carried out the vacuum deairing of the trade name NK ester 1206PE(new Nakamura chemistry company make) 30 weight section, the trade name 23G (new Nakamura chemistry company make) 25 weight section, and the carbon molecular sieve that ground after performing 120-degree C vacuum stoving for 24 hours, and was made into 3 micrometers of mean diameters as a curing agent using 40 weight sections was used as the hardenability resin constituent. This hardenability resin constituent was covered for 1 minute using the high pressure mercury vapor lamp, and the ultraviolet rays of 20 mJ/cm² were irradiated, it solidified, and the 3.3cmx3.3mmx0.3mm plate-like gas adsorption nature member was produced. In addition, production of the above gas adsorption nature member was performed in the argon permutation glove compartment installed in the dry room whose dew-point is -45 degrees C.

[0065] The above-mentioned cell component and the above-mentioned gas adsorption nature member were inserted in the inclusion body which consists of a laminate film, thermal melting arrival was carried out with the sealing machine on 200 degrees C and the conditions for 10 seconds at the seal width of 5mm, and it considered as the trial cell.

[0066] <Example 2> Diethyl carbonate was used instead of the propylene carbonate which constitutes the above-mentioned plasticizer, and the trial cell was produced like the example 1 except having made the carbon molecular sieve of 3 micrometers of mean

diameters into 32 weight sections from 40 weight sections.

[0067] <Example 3> The trial cell was produced like the example 1 except having used the propylene carbonate of 85 weight sections for the ethylene carbonate which constitutes the above-mentioned plasticizer instead of the mixed solvent of the 42.5 weight sections and the propylene carbonate 42.5 weight section, and having used the grinding silica gel of 5 micrometers of mean diameters instead of the carbon molecular sieve of 3 micrometers of mean diameters.

[0068] <Example 4> Instead of a winding mold gel electrolyte cell component, the monotonous mold gel electrolyte cell component of 1200mAh(s) is produced by 140mmx196mmx0.46mm as shown in drawing 10. The trial cell was produced like the example 1 except having used the laminate film which has the gas adsorbent layer which connotes the carbon molecular sieve of 3 micrometers of mean diameters as shown in drawing 8 instead of a plate-like gas adsorption nature member as a configuration layer.

[0069] <Example 5> The trial cell was produced like the example 4 except having used diethyl carbonate instead of the propylene carbonate which constitutes the above-mentioned plasticizer.

[0070] <Example 6> The trial cell was produced like the example 4 except having used the propylene carbonate of 85 weight sections for the ethylene carbonate which constitutes the above-mentioned plasticizer instead of the mixed solvent of the 42.5 weight sections and the propylene carbonate 42.5 weight section, and having used the grinding silica gel of 5 micrometers of mean diameters instead of the carbon molecular sieve of 3 micrometers of mean diameters.

[0071] <Example 1 of a comparison> The trial cell was produced like the example 1 except having not used the carbon molecular sieve which is the gas adsorption nature matter.

[0072] <Example 2 of a comparison> The trial cell was produced like the example 2 except having not used the carbon molecular sieve which is the gas adsorption nature matter.

[0073] <Example 3 of a comparison> The trial cell was produced like the example 3 except having not used the grinding silica gel which is the gas adsorption nature matter.

[0074] <Example 4 of a comparison> The trial cell was produced like the example 4 except having not used the carbon molecular sieve which is the gas adsorption nature matter.

[0075] <Example 5 of a comparison> The trial cell was produced like the example 5 except having not used the carbon molecular sieve which is the gas adsorption nature matter.

[0076] <Example 6 of a comparison> The trial cell was produced like the example 6 except having not used the grinding silica gel which is the gas adsorption nature matter.

[0077] About the trial cell of the example 1 produced as mentioned above - an example 6 and the example 1 of a comparison - the example 6 of a comparison, the evaluation experiment about adsorbent [of the gas which occurred by the cell reaction] was conducted.

[0078] First, the trial cell of an example 1 - an example 6 and the example 1 of a comparison - the example 6 of a comparison was overcharged to 4.35V at the rate of 2 time amount of geometric capacity (1/2C), after charging initially at the rate of 5 time amount of geometric capacity (1/5C), respectively. And the trial cell in the condition of

having overcharged was left in the 100-degree C thermostat for 100 hours.

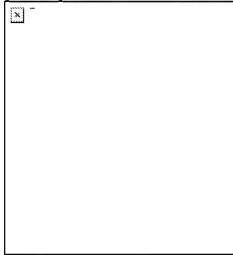
[0079] Immediately after having picked out the trial cell from the thermostat after 100-hour neglect, and taking out from a thermostat, it set, after cooling to a room temperature, and viewing observed and estimated the bulging degree of a laminate film.

[0080] Consequently, without a laminate film expanding, the adhesion of a cell component and a laminate film was maintained, and when the cell configuration was maintained, it evaluated as O. Moreover, the cell configuration was evaluated as **, when a clearance was made between a cell component and a laminate film and adhesion was not maintained at it, although maintained mostly. Moreover, the laminate film expanded, and when the cell configuration was not maintained, it evaluated as x.

[0081] The gas adsorption nature evaluation result about the trial cell of an example 1 - an example 6 and the example 1 of a comparison - the example 6 of a comparison is shown in Table 1.

[0082]

[Table 1]



[0083] Although that to which the laminate film loosened a little immediately after taking out from a 100-degree C thermostat was also seen, by the trial cell of the example 1 which threw in the gas adsorption nature matter - an example 6, it turned out that all do not have looseness of a laminate film after room temperature cooling, either, and the adhesion and the cell configuration of a cell component and a laminate film are maintained, so that clearly from Table 1.

[0084] On the other hand, by the trial cell of the example 1 of a comparison which did not throw in the gas adsorption nature matter - the example 6 of a comparison, immediately after taking out from a 100-degree C thermostat, the laminate film was expanding and the cell configuration was not maintained for a gap, either. And the swelling of a laminate film was not canceled after room temperature cooling.

[0085] It turned out that the gas which occurs from the above result by feeding the gas adsorption nature matter between a cell component and laminate films or into a laminate film when a cell sets in the abnormality situations under overcharge or an elevated temperature etc. can be adsorbed with the gas adsorption nature matter, and form status change-ization by the swelling of a cell can be suppressed.

[0086]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the decomposition perspective view showing the example of 1 configuration of the nonaqueous electrolyte cell by which this invention was applied.

[Drawing 2] It is the outline perspective view showing the example of 1 configuration of the nonaqueous electrolyte cell by which this invention was applied.

[Drawing 3] It is the outline perspective view showing the condition of having covered the whole surface of a cell component by the gas adsorption nature member.

[Drawing 4] It is the 3rd page Fig. showing the volume loss section at the time of covering the whole surface of a cell component by the gas adsorption nature member.

[Drawing 5] It is the outline perspective view showing signs that the gas adsorption nature member fabricated beforehand is attached.

[Drawing 6] It is the outline perspective view showing the formation condition of the gas adsorption nature member formed of restoration of resin.

[Drawing 7] It is the sectional view showing the example of 1 configuration of the laminate film which has a gas absorptivity layer.

[Drawing 8] It is the sectional view showing the example of 1 configuration of the laminate film which has a gas absorptivity layer.

[Drawing 9] It is the outline perspective view showing the dimension of the cell component produced in the example.

[Drawing 10] It is the outline perspective view showing the dimension of the cell component produced in the example.

[Description of Notations]

1 Cell Component, 2 Sheathing Material, 3 Negative-Electrode Terminal Lead, 4 Positive-Electrode Terminal Lead, 5, 6, 7 Gas Adsorption Nature Member
